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ABSTRACT

In order to better understand problems encountered in meeting the particular agricultural education and training needs of students from developing countries, 30 students enrolled in the College of Agriculture at the University of Minnesota in academic year 1983-84 were interviewed to assess individual backgrounds and agricultural training to date, and to relate present training levels to the students' perception of needs in their home countries. A general overview is provided of the average farm size and labor force engaged in farming in the students' countries of origin. Respondents' characteristics were identified and included individual background, educational training, number of years in the United States, source of academic funding, city or rural origination, parents' occupations, size of land owned and farmed, work experience, and occupation on return home. Student responses showed that the education/training of agriculturalists in United States institutions of higher learning does not relate sufficiently to the domestic needs of farming cultures in less industrialized countries (LICs), and that it should be predicated on local capacities and innovations for use in LIC farming. LIC students in colleges of agriculture in the United States should gain practical experience through work with farmers in the United States whose farming practices are applicable to farming cultures, systems, and practices in the LICs. (JMM)

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TRANSFERRING RELEVANT FARM TECHNOLOGY TO STUDENTS FROM LESS INDUSTRIALIZED COUNTRIES

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ABSTRACT

This paper outlines and discusses the problems which are encountered in meeting the particular agricultural education and training needs of students from developing countries, based on a survey of these students attending the University of Minnesota in 1983-84. A random sample of 30 was taken from a total population of 160 students, enrolled in the College of Agriculture, from Less Industrialized Countries (LICs) where over 30% of the labor force is engaged in farming. All students in the sample were interviewed to assess individual backgrounds and training to date in agriculture, and to relate present levels of training to the students' perception of needs in their home countries. Described in this paper are characteristics of students' countries of origin, average farm size and labor force engaged in farming. Respondents' characteristics were identified and included individual background, agricultural situation in respondents' countries and educational training at the University of Minnesota, total number of years spent in the United States, source of academic funding, city or rural origination, parents' occupations, size of land owned and farmed, work experience to date and occupation on return home.

A content analysis of student responses gave the following results:

(1) The students' course of study needs breadth to stimulate creativity and systems independence for problem solving in a limited resource setting.

(2) Opportunities must be opened to make the techniques and knowledge acquired by LIC students during schooling in the U.S. more applicable to the kinds of situations existing in LIC countries.

The major conclusion of this study is that the education and training of agriculturalists in U.S. institutions of higher learning does not relate sufficiently to the domestic needs of farming cultures in LIC countries. This conclusion is supported by recent studies and reports by USAID (United States Agency for International Development) and the International Institute of

Tropical Agriculture (IITA) in Nigeria. These agencies suggest the need for development schemes that build upon local capacities and innovations in agriculture that are suitable to the cultural and environmental needs of the LIC's agricultural base. The present study leads to the additional recommendation that agricultural education and training of LIC students in the U.S. should also be predicated on local capacities and innovations for use in LIC farming.

The frequent assumption that there are relevant and meaningful parallels between agriculture in the U.S. and that in LICs is brought into question by these results. Two major recommendations are advanced, based on a study carried out by the United Stated Department of Agriculture (USDA) in 1980, which propose, describe and explain how field experience can be included in study programs. The direction and approach of LIC student education should be refocused; LIC students in U.S. colleges of agriculture should gain practical experience through work with farmers in the U.S. whose farming practices enable students to make applications which will accommodate and reflect the realities of farming cultures, systems and practices in the LICs.

Such low-input farming practices include: the development of favorable micro-climate and a diverse biological balance on the farm; soil building programs including composting of farm wastes, green manure applications and the use of legumes and salinity management; proper tillage techniques; self-reliance to as great an extent as possible in personal food and energy supplies, feed and fertilizers; and the collective development of the rural economy and community. Farming systems of this nature in the U.S. are also referred to as 'organic,' 'biological,' 'regenerative' and 'sustainable.'

INTRODUCTION

The position and development of agriculture in the developed countries contrasts sharply with the prevailing situations in LICs. Agriculture in Less Industrialized Countries (LIC) is constrained by serious resource limitations. Although farmers in LICs comprise 80 percent of the world's farmers, they farm an average of less than 11 acres of land. Thirty-nine percent of these individuals have fewer than 2.5 acres. LICs are characterized by subsistence farming with under-capitalization, minimal education and limited resources (Harwood, 1980).

Agriculture in the Western countries, especially the U.S., has "leaped ahead" technologically. However, Western practitioners and academicians seem to assume that advanced technologies are transferable to wholly different circumstances in other regions of the world.

Universities, as major teaching institutions at higher levels, remain centrally involved in this process of "technology transfer." Yet, the unconscious and unwitting acceptance of Western agricultural instruction by students from LICs has led to growing concern about the relevance of education and training LIC students receive at U.S. colleges of agriculture (Barrier, 1985; Blumberg, 1986).

Studies indicate that university-trained graduates frequently are uncritical and imitative practitioners of knowledge that is generated in other contexts and for purposes unsuitable to small farmers in LICs (Blumberg, 1986; Lee, 1983).

Transferring Relevant Farm Technology

THE PROBLEM

The optimism of the sixties and early seventies generated by the promise of transfering modern agricultural technologies to LICs to solve production problems has faded. These technologies yield spectacular results only in situations where soils are fertile and other production factors optimal. Such conditions are found in less than 20% of the arable land of LICs where small-scale, resource-limited farming supports the majority of the population. There are about 109 million farmers in LICs on such farms (Office of Technology Assessment (OTA), 1981).

The bleak agricultural situation in LICs emanates not just from the lack of resources, but from the well documented application of inappropriate technologies. Teaching institutions play a major role in the transfer of these technologies vis-a-vis what Alatas (1975) has called the "captive mind syndrome." A "captive mind" is the product of higher institutions of learning, such as U.S. land-grant institutions, whose method of teaching is conditioned by Western perspectives and thought. As a result, there is growing concern about the relevance of educational training international students receive in U.S. land-grant colleges of agriculture (Blumberg, 1986; Barrier, ed. 1985; Lee, 1983).

In 1977, the U.S. land-grant system increased its involvement in international agriculture under the auspices of Title XII, a 1975 amendment of the Foreign Assistance Act of 1962 (U.S. Agency for International Development (AID), 1978).

A major contribution of the Title XII amendment has been the education of international students at U.S. land-grant universities. In recognition of the contributions that land-grant universities have made to American agriculture, the Title XII intent is to bring expertise to bear on world food problems. Ideally, universities' instructional and research de-

partments and extension services would help develop LIC agriculture. In fact, 25% of all graduate students studying agriculture in the United States are from LICs (National Center for Education Statistics in Barrier ed., 1985).

The strategies of the 1862 and 1890 land-grant colleges that should continue to be extended to LIC students under Title XII:

1. Involvement of the people to be served in the planning for community and resource development;
2. Identification and utilization of indigeneous leadership in program implementation;
3. Helping people help themselves; and
4. Hands on experience and demonstration teaching rather than theoretical instruction.

The National Association of Foreign Student Affairs (NAFSA) held a workshop in 1980 to address issues of technology transfer. A recurrent theme in their discussion was the imperative need for practical training to enhance students' self-reliance and capacity for adoption of Western innovations. Recommendations put forward by the commission include:

> Practical experience, through some type of internship which could constitute part of the degree program so that schools could formally assist students, particularly those in certain fields. Relevant practical experience can enhance the application of knowledge learned in class (Lee, et al., 1981).

A major theme in the literature about the relevance of U.S. education to students from LICs is that inadequancies are apparent in the application of the knowledge gained in the U.S. to the situations faced in their countries. Students and alumni from LICs emphasize that practical experience is needed as well as formal education to provide the self-confidence to act independently and to fulfill the role of innovator and adapter (Coleman, 1984).

RESEARCH DESIGN AND METHODS

Previous studies about relevance of U.S. agricultural education provided to students from LICs have relied on written surveys with predetermined and

standardized categories, stopping short of specific recommendations for increasing the relevance of such education. This study, conducted in 1983/84, involved open-ended interviews of 30 international students enrolled in the University of Minnesota's College of Agriculture. The randomly selected sample, from a population of 160 students from LICs enrolled in the College of Agriculture, was stratified by department of study and region of national origin (Appendix II, Table 1).

A semi-structured interview format (Gorden, 1973), allowing students to respond at length in reference to the questions put to them, was used in order to understand and capture the points of view of the students without predetermining their responses through prior selection of response categories.

To avoid leading questions, Spradley's (1979) developmental research sequence was used in the actual research process.

The interview (Appendix I) focused on three principal areas: the students' experience and agricultural background listed in Table 2; in addition to the agricultural situation in their countries and specific coursework at the University of Minnesota.

By using Berelsons's (1952) inductive content analysis, themes were identified in the students' responses to the questions. Emerging themes in the content were used to formulate appropriate categories. Quotations were selected representing common themes in order to illustrate and humanize the data and address the major research question: "How can the educational experience of students from LICs be made more relevant to the agricultural needs of their countries?"

Information was collected from the United States Department of Agriculture's Report and Recommendations on Organic Farming (1980) to substantiate, support and highlight the students' insights.

THE FINDINGS

STUDENTS' AGRICULTURAL BACKGROUND

The majority of the students had spent more than two years at the University of Minnesota. More than half came from urban areas and land-owning families; yet less than half of them had any farm experience. Sixty-three percent of those interviewed were on scholarship and were obligated to serve their countries upon completion of their academic program.

COUNTRIES' AGRICULTURAL SITUATION

According to 87% of the students interviewed, the primary goal of their countries is self-sufficiency in agriculture. Yet, they said, most capital inputs, used in on U.S. farms to increase production, were considered scarce, erratic in supply, or virtually unavailable to the farmers.

The students explained that optimum use of farm resources involves diversification of the farming system to reduce risks. By selecting various crop and livestock enterprise that have complementary requirements, small farmers try to maximize available resources.

Factors that limit the productive capacity of the countries' agricultural sector were identified as poor soil fertility, water shortages and absence of agricultural inputs, and a lack of local, regional, and national infrastructure. The majority of respondents associated the development of, and training in, appropriate technology as solutions to these agricultural problems.

STUDENTS IMPRESSION OF U.S. EDUCATION

In light of the students' previous experiences in their countries' agricultural sector, it was important to determine what the students considered valuable about their U.S. education. "Learning how to conduct research," was the higheat response category (33%). In short, there was often no response in this area.

When asked what students from LICs need to learn to cope with the agricultural situations in their countries, a recurring theme was the need to learn how to analyze existing environments and socio-cultural data. However,

those interviewed said they lack instruction about how to interpret and extrapolate research formulated in U.S. universities. The students noted, for example, that small farmers in LICs are engaged in mixed crop-livestock systems, but questioned why agriculture schools in the U.S. encouraged them to research single crop or specie systems in isolation from other variables.

Sixty-three percent said that their agricultural training at the University of Minnesota lacked relevance, leaving them unprepared to deal effectively with agricultural problems in their countries.

The majority said that more instruction is needed about optimizing production with limited resources. The complexity of problems faced in the farm sector of LICs, listed in Appendix III, make interdisciplinary collaboration essential, but their training left them unaccustomed to working together on common problems.

In reaction to student reponses concerning instruction about optimizing production with limited resources, they were challenged to answer what and how this can be done. The repondent was asked to role play. S/he was assigned the position of Dean of the College of Agriculture, and was then asked to describe and recommend an appropriate agricultural training program for students from LICs.

Appendix III also includes suggestions for bridging the gap between the education received in the U.S. and the agricultural situations in their countries. The majority of responses referred to the incorporation of appropriate field experiences, which would expose them to resource-efficient farm technologies appropriate for diversified farming.

In 1980, the USDA completed their Report and Recommendations on Organic Farming. They concluded that the regenerative nature of organic farming in the U.S., including the objectives, practices, problems and solutions encountered on organic farms, are similar to low-input farming systems in LICs. In

Appendix III student responses are cross-referenced with the USDA's remarks, illustrating how a better understanding of the regenerating capabilities of organic farming systems might provide valuable information for LICs. Yet 86% of those interviewed knew nothing about organic farming or similar low-input systems in the U.S.

CONCLUSIONS AND RECOMMENDATIONS

Based on the overwhelming similarity between the students' responses, in correlation with, the literature on organic, sustainable, regenerative and low-input agriculture, two major recommendations emerged. The most frequent suggestion was to include an extended field experience as part of academic programs to enable students to make appropriate translations and applications of classroom material to agriculture in their countries.

The second recommendation, based on student responses, includes refocusing the direction and approach of student research to encompass the technical and socio-cultural components and limitations LICs' farming systems. Studies should be directed towards increasing the productivity and welfare of small farming households. Harwood (1979) suggests this research should be planned and carried out in collaboration with resource-efficient farmers. Such an approach would help students appreciate the value of collaboration between farmers and scientists in the identification of problems and the implementation of solutions through agricultural research.

Although the Title XII mandate attempts to bring the land-grant philosophy to bear in solving agricultural problems in LICs, the USDA (1980) takes the land-grant universities to task for failing to address the importance of low-input, organic farming.

Here-in lies the irony of the problem. Although land-grant institutions have embraced the concepts of assistance to limited resource farmers in LICs

through Title XII, they have failed to examine the contribution that regenerative, low-input agriculture could make to fulfilling the XII mission. A final section of the USDA report (1980, p. 81) addresses itself in part to this problem:

> "6.2.6 Technology Development—To improve farm technology in the United States and Developing Countries—Many organic farms are similar to those of self-sustaining unit systems predominate in developing countries. Thus, a better understanding of the technological aspects of organic farming in the United States may provide valuable information for increasing the stability and productivity of such systems in developing countries."
> and
> "Lower Input Costs—Organic farmers generally have lower input costs than conventional farmers. Consequently, some farmers especially those on small farms with cash flow problems, may benefit from organic farming by reducing their cash flow needs. Moreover, if the cost of chemical fertilizers continues to increase relatively faster than the cost of other farm inputs, greater opportunities to farm organically may become available for farmers, especially farmers on mixed crop-livestock farms."

One way land-grant universities could administer practical, appropriate field experiences for educational purposes is to take advantage of the internship program developed by the International Federation of Organic Agriculture Movements (IFOAM). IFOAM's program, "Working Weekends on Organic Farms" (WWOOF) is a network of farmers using low-input farming methods. It embodies several objectives identified by the students interviewed: "direct experience with resource-efficient farmers, experience working on diversified farms to find interdisciplinary solutions to small farm problems, and an appreciation of the farmer as a valuable partner in the research, development and technology implementation process" (IFOAM, 1982). Appendix III illustrates the students' recommendations, aligned with excerpts from the USDA (1980). This, perhaps, is the greatest challenge in the development and extension of appropriate, sustainable agricultural technologies to meet growing demands on the world's food supply and on associated environmental problems. This challenge can be addressed through the development and transfer of appropriate

technology, to students from LICs, by incorporating relevant field experiences into their educational programs. But whether in the U.S. or in an LIC, any agricultural production system, if it is to be effective, must be designed to help farmers solve production problems and meet their goals. Therefore, the natural preoccupation of our colleges of agriculture with domestic issues need not restrict our ability to address agriculture problems of other countries.

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APPENDIX I
INTERVIEW QUESTIONS

BACKGROUND INFORMATION

1. How long have you been in the U.S.? In Minnesota?
2. Do you have an urban or rural background?
3. What were your parents occupations as you were growing up?
4. What was your work experience prior to arriving in the USA?
5. Did you have any background or training in agriculture?
6. Does your family own any land?
7. What is your major source of funding?
8. What position will you occupy upon your return home?
9. Who will be your employer?

AGRICULTURAL SITUATION IN RESPONDENTS' COUNTRIES

1. What do you consider to be the three most important agricultural needs in your country?
2. What are the solutions for the problem areas you have identified?
3. What do you consider to be the most important technological innovation in agriculture introduced in your country?
4. Can you describe any innovations that were not successful? 5. What are the indigeneous sources of fertilizers, pesticides and farm machinery?
6. What percentage of the farm sector is comprised of small-scale farmers? Does national research and development reflect this?
7. Are farm families receptive to new technologies? Why?
8. Are you aware of the effects any agricultural practices on the environment?
9. Is there a long-range plan for agriculture in your country? If so what?
10. In your opinion should there be any agricultural development in your country? If so, how should it take place?

EDUCATIONAL TRAINING at the UNIVERSITY OF MINNESOTA

1. Describe how your present education and training is going to be useful when you return home. What have you learned that can be useful when you return home?
2. How would you change the training program at the University to help you bridge the gap between what you are learning here and the situation in your country?
3. What field experience or practical application have you received in your training program?
4. Describe a program for field experience in the University's College of Agriculture that would help you in addressing the needs of your country's agricultural sector?
5. What is the subject of your thesis research? Were your needs or those of your country considered in topic selection?
6. Based on your answers, do you have any additional suggestions for improving your agricultural training at the University?

TABLE 1: Characteristics of International Student Sample

A. Background by Country

No. of students	Country of origin	National Farm Data: average acreage	National Farm Data: %labor force
5	Nigeria	10.3	90
4	Indonesia	2.6	66
2	Brazil	95.8	56
2	India	16.1	69
2	Iraq	18	47
2	Kenya	10.4	82
2	Phillipines	8.9	53
1	Barbados	.4	61
1	Iran	14.9	46
1	Columbia	—	79
1	Ghana	6.5	58
1	Ecuador	20.1	51
1	China	3.1	68
1	Peru	50.3	70
1	Bangladesh	5.8	86
1	Algeria	11	61
1	Morrocco	11.4	57
1	Thialand	8.6	80

B. Breakdown by geographical region

No. of students	Percentage	Region
11	37	Asia
10	33	Africa
6	20	Latin America
3	10	Middle East

C. Breakdown by Program of Study

No. of Students	Percentage	Program
6	20	Animal Science
6	20	Agronomy
5	17	Ag. Engineering
5	17	Ag. Economics
3	10	Soil Science
2	6.5	Plant Pathology
2	6.5	Plant Breeding
1	3	Forestry

D. Background by Degree Track

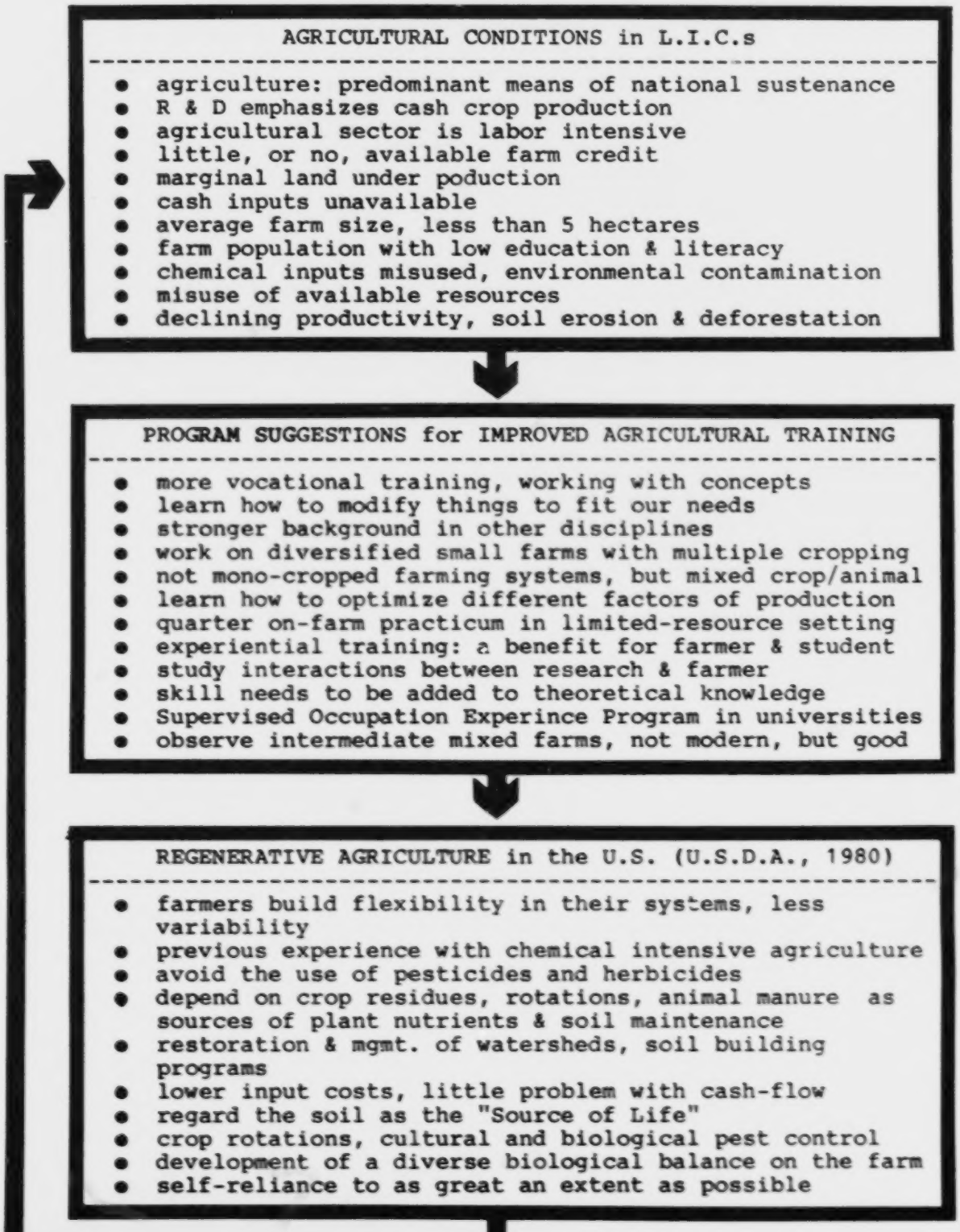
No. of Students	Percentage	Degree
24	80	Ph.D.
5	17	M.A.,M.S.,M.Ag.
1	3	Undergraduate

Table 2: Breakdown of Student Sample Responses to Queiries on Agricultural Expereince

Query	Response	No.	Percentage
1. Yrs. of study in U.S.	1 year	6	20
	2 years	13	43
	3 years	7	23
	4+ years	4	13
2. Sources of Funding	gov't.	12.5	42
	A.I.D.	3.5	12
	World Bank	3	10
	R.A.	7	23
	private	2	6.5
	other	2	6.5
3. Background	city	19	63
	rural	11	37
4. Occupation of Parents	government	13	43.3
	private	13	43.3
	farming	4	13.3
5. Land Ownership	none	11	37
	10 acres	4	13
	50 acres	7	23
	over 300	2	7
	absentee	4	13
	communal	2	7
6. Work Experience	Teaching	10	33
	Research	17	57
	None	3	10

APPENDIX III

Diagram 1: An Experiential Training Program for the Developmemt and Extension of Relevant Technologies to Resource Limited Farmers


AGRICULTURAL CONDITIONS in L.I.C.s
• agriculture: predominant means of national sustenance
• R & D emphasizes cash crop production
• agricultural sector is labor intensive
• little, or no, available farm credit
• marginal land under poduction
• cash inputs unavailable
• average farm size, less than 5 hectares
• farm population with low education & literacy
• chemical inputs misused, environmental contamination
• misuse of available resources
• declining productivity, soil erosion & deforestation
PROGRAM SUGGESTIONS for IMPROVED AGRICULTURAL TRAINING
• more vocational training, working with concepts
• learn how to modify things to fit our needs
• stronger background in other disciplines
• work on diversified small farms with multiple cropping
• not mono-cropped farming systems, but mixed crop/animal
• learn how to optimize different factors of production
• quarter on-farm practicum in limited-resource setting
• experiential training: a benefit for farmer & student
• study interactions between research & farmer
• skill needs to be added to theoretical knowledge
• Supervised Occupation Experince Program in universities
• observe intermediate mixed farms, not modern, but good
REGENERATIVE AGRICULTURE in the U.S. (U.S.D.A., 1980)
• farmers build flexibility in their systems, less variability
• previous experience with chemical intensive agriculture
• avoid the use of pesticides and herbicides
• depend on crop residues, rotations, animal manure as sources of plant nutrients & soil maintenance
• restoration & mgmt. of watersheds, soil building programs
• lower input costs, little problem with cash-flow
• regard the soil as the "Source of Life"
• crop rotations, cultural and biological pest control
• development of a diverse biological balance on the farm
• self-reliance to as great an extent as possible